Warnings of local frost were issued for Utah, western Colorado and the mountain districts of New Mexico on the 1st, as relatively high pressure prevailed on the western slope attended by abnormally low temperature. While frost temperatures occurred in places, with freezing weather in northeastern Arizona, a considerable rise in temperature prevented further serious damage. Frost warnings for western Utah were issued on the 13th, when the pressure was low in Rocky Mountain districts and an anticyclonic area was advancing eastward from the middle Pacific. Frost temperatures occurred in localities. On the 22d advices of possibly local frost were issued for western Utah. The center of an area of low pressure occupied the middle Rocky Mountain section, with cooler weather in the Plateau region, frost in Nevada, and rising pressure on the California coast. The rapid development of an area of low pressure of considerable intensity in Nevada was attended by rising temperature.—Frederick W. Brist.

## SAN FRANCISCO FORECAST DISTRICT.

During the month of June the high-pressure area over the eastern portion of the North Pacific Ocean was slower than usual in gaining strength and stability; consequently it did not impinge on the coast to any great extent till near the end of the month. The result was the formation of irregular-shaped troughs of low pressure over the Rocky Mountain and Pacific States that caused protracted spells of cool and unsettled weather in the San Francisco Forecast District. The passage eastward of these trough-shaped low-pressure areas was more or less checked by the presence of persistent high-pressure areas over the Mississippi Valley and the Atlantic States. This type of weather while difficult to predict was of inestimable benefit to the grain crops, and it did much to prevent the spread of forest fires, which sometimes are numerous at this time of the year, especially in the southern portion of the district.

The only warning issued was for light-to-heavy frost in exposed places in Idaho on the 16th inst. No storm warnings were issued nor were any necessary.—E. A. Beals.

## RIVERS AND FLOODS.

By H. C. Frankenfield, Meteorologist.

The only great flood of the month occurred in the Arkansas River from the vicinity of Hutchinson, Kans., to the mouth of the river. To the westward, the river was only in moderate flood, and flood stages were not reached except at Fort Lyon, Colo., where the river was above the flood stage of 6 feet on June 17, with a crest

stage of 10 feet at 8 p. m.
It is evident that the major portion of this rise came from the Purgatoire River, at Higbee, Colo., on that river, reported the washing out of the river gage on June 17, at a stage of 10 feet, or 6 feet above the flood stage, with the river still rising. Flood warnings for the Arkansas River from Fort Lyon to the Kansas line were issued at once, and no serious damage was reported, as the excess water was apparently diverted to the irrigation canals. Other streams in northeastern Colorado were also in flood.

The following account of the flood from Hutchinson, Kans., eastward was summarized from the detailed reports of Messrs. S. P. Peterson, T. G. Shipman, H. S. Cole, and J. P. Slaughter in charge of the river districts-

Wichita, Kans., Fort Smith, Ark., Little Rock, Ark., and and Oklahoma City, Okla., respectively. The rainfall responsible for the floods is shown in the following table:

Rainfall, May 21 to June 17, inclusive, 1923.

Macksville, Kans         Arkansas         9.           Grest Bond, Kans         do         9.           Hutchinson, Kans         do         11.           Medora, Kans         do         12.           McPherson, Kans         do         11.           Heston, Kans         Little Arkansas         11.           Newton, Kans         do         12.           Sedgwick, Kans         do         12.           Sedgwick, Kans         do         13.           Wichita, Kans         Arkansas         18.           Raiston, Okla         do         6.           Tuisa, Okla         do         11.           Webbers Falls, Okla         do         11.           Webbers Falls, Okla         do         8.           Emporia, Kans         Cottonwood         12.           LeRoy, Kans         do         9.           Iola, Kans         do         9.           Segwego, Kans         do         9.           Oswego, Kans         do         9.           Vayandotte, Okla         do         7.           Vayandotte, Okla         do         7.           For Gibson, Okla         North Fork Canadian <t< th=""><th>Station.</th><th>River.</th><th>Total for 28 days.</th></t<>	Station.	River.	Total for 28 days.
Macksville, Kans         Arkansas         9.           Grest Bond, Kans         do         9.           Hutchinson, Kans         do         11.           Medora, Kans         do         12.           McPherson, Kans         do         11.           Heston, Kans         Little Arkansas         11.           Newton, Kans         do         12.           Sedgwick, Kans         do         12.           Sedgwick, Kans         do         13.           Wichita, Kans         Arkansas         18.           Raiston, Okla         do         6.           Tuisa, Okla         do         11.           Webbers Falls, Okla         do         11.           Webbers Falls, Okla         do         8.           Emporia, Kans         Cottonwood         12.           LeRoy, Kans         do         9.           Iola, Kans         do         9.           Segwego, Kans         do         9.           Oswego, Kans         do         9.           Vayandotte, Okla         do         7.           Vayandotte, Okla         do         7.           For Gibson, Okla         North Fork Canadian <t< td=""><td></td><td></td><td>Inches.</td></t<>			Inches.
Hutchinson, Kans	Macksville, Kans	Arkansas	9. 3:
Hutchinson, Kans	Great Bond, Kans	do	9. 9
Hesston, Kans	Hutchinson, Kans	do	11.0
Hesston, Kans	Medora, Kans	do	12. 7
12   12   12   12   12   13   14   15   15   15   15   15   15   15	McPherson, Kans	do	11.0
12   12   12   12   13   14   15   15   15   15   15   15   15	Hesston, Kans	Little Arkansas	11. 9
Sedgwick, Kans.   do	Newton, Kans	do	12.6
Wichita, Kans.	Sedgwick, Kans.	ldo	13. 1
Tulsa, Okla. do 8.  Emporia, Kans do 8.  Emporia, Kans Octtonwood 12.  Neosho Rapids, Kans Neosho 10.  LeRoy, Kans do 9.  Jola, Kans do 7.  Wyandotte, Okla do 17.  Wyandotte, Okla do 12.  Okay, Okla Verdigris 7.  Fort Gibson, Okla North Fork Canadian 7.  Union City, Okla do 7.  Woodward, Okla do 7.  Woodward, Okla do 7.  Woodward, Okla do 7.  Canton, Okla do 7.  Canton, Okla do 7.  Calvin, Okla do 8.  Reno Junction, Okla Bodo 8.  Reno Junction, Okla Bodo 8.  Reno Junction, Okla Bodo 9.  Calvin, Okla Canadian 8.  Fort Smith, Ark Arkansas 8.  Salico Rock, Ark Danville, Ark Arkansas 5.  Calico Rock, Ark Arkansas 5.  Salico Rock, Ark Arkansas 5.  Batesville, Ark do 8.  Batesville, Ark Batesville, Ark Black 7.  Patterson, Ark Black 7.  Patterson, Ark White 11.	Wichita, Kans.	Arkansas	18.3
Tulsa, Okla. do 8.  Emporia, Kans do 8.  Emporia, Kans Octtonwood 12.  Neosho Rapids, Kans Neosho 10.  LeRoy, Kans do 9.  Jola, Kans do 7.  Wyandotte, Okla do 17.  Wyandotte, Okla do 12.  Okay, Okla Verdigris 7.  Fort Gibson, Okla North Fork Canadian 7.  Union City, Okla do 7.  Woodward, Okla do 7.  Woodward, Okla do 7.  Woodward, Okla do 7.  Canton, Okla do 7.  Canton, Okla do 7.  Calvin, Okla do 8.  Reno Junction, Okla Bodo 8.  Reno Junction, Okla Bodo 8.  Reno Junction, Okla Bodo 9.  Calvin, Okla Canadian 8.  Fort Smith, Ark Arkansas 8.  Salico Rock, Ark Danville, Ark Arkansas 5.  Calico Rock, Ark Arkansas 5.  Salico Rock, Ark Arkansas 5.  Batesville, Ark do 8.  Batesville, Ark Batesville, Ark Black 7.  Patterson, Ark Black 7.  Patterson, Ark White 11.	Ralston, Okla	do	6. 1
Webbers Falls, Okla         do         8           Emporia, Kans         Cottonwood         12           Neosho Rapids, Kans         Neosho         10           LeRoy, Kans         do         9           Jola, Kans         do         8           Oswego, Kans         do         7           Wyandotte, Okla         do         12           Okay, Okla         Verdigris         7           Fort Gibson, Okla         Neosho         6           Camargo, Okla         North Fork Canadian         7           Union City, Okla         do         7           Woodward, Okla         do         9           Canton, Okla         do         8           Reno Junction, Okla         do         8           Kenor Junction, Okla         do         5           Calvin, Okla         do         7           Calvin, Okla         do         7           Fort Smith, Ark         Arkansas         8           Dardanelle, Ark         do         8           Dardanelle, Ark         Petit Jean         8           Dardanelle, Ark         Petit Jean         8           Satesville, Ark         Phie         8 </td <td>Tulsa Okla</td> <td>i do l</td> <td>11.3</td>	Tulsa Okla	i do l	11.3
101a, kans	Webbers Falls, Okla	-do	8.5
10la, kans	Emporia, Kans	Cottonwood	12. 1
10la, kans	Naosho Ranids, Kans	Neosho	10.0
10la, kans	LaRov Kans	do	9.6
Oswego, Kans         do         7.           Wyandotte, Okla         do         12.           Okay, Okla         Verdigris         7.           Fort Gibson, Okla         Neosho         6.           Camargo, Okla         North Fork Canadian         7.           Union City, Okla         do         9.           Canton, Okla         do         9.           Canton, Okla         do         5.           Oklahoma City, Okla         do         7.           Calvin, Okla         do         7.           Calvin, Okla         Canadian         8.           Fort Smith, Ark         Arkansas         8.           Darville, Ark         do         8.           Danville, Ark         Pett Jean         8.           Little Rock, Ark         White         8.           Satesville, Ark         do         8.           Sweport, Ark         do         8.           Pine Bluff, Ark         Arkansas         6.           Black Rock, Ark         Black         7.           Patterson, Ark         Cache         14.           Georgetown, Ark         White         11.	Tola Kans	do	8.6
Wyandotte, Okla         do         12           Okay, Okla.         Verdigris.         7.           Fort Gibson, Okla.         Neosho.         6.           Camargo, Okla.         North Fork Canadian.         7.           Union City, Okia.         do.         9.           Canton, Okla.         do.         9.           Keno Junction, Okla.         do.         5.           Oklahoma City, Okla.         do.         7.           Calvin, Okla.         Canadian.         8.           Fort Smith, Ark.         Arkansas.         8.           Darville, Ark.         Petti Jean.         8.           Little Rock, Ark.         Arkansas.         5.           Calico Rock, Ark.         White.         8.           Batesville, Ark.         do.         8.           Newport, Ark.         do.         12.           Pine Bluff, Ark.         Arkansas.         6.           Black Rock, Ark.         Black.         7.           Patterson, Ark.         Cache.         14.           Georgetown, Ark.         White.         11.	Osurago Fana	الما	7 0
Voodwart, Okia   Vood	Wwandotta Okla	do	12. 2
Voodwart, or   Vood	Okay Okla	Vardigris	7. 1
Voodwart, Okia   Vood	Fort Cibeon Okla	Nancho	6.9
Voodwart, Okia   Vood	Camaron Okla	North Fork Consdian	7.9
Voodwart, Okia   Vood	Union City Obla	do	7.3
Canton, Okla         do         8           Reno Junction, Okla         do         5           Okiahoma City, Okla         do         7           Calvin, Okla         Canadian         8           Fort Smith, Ark         Arkansas         8           Dardanelle, Ark         do         8           Danville, Ark         Petit Jean         8           Little Rock, Ark         Arkansas         5           Calico Rock, Ark         White         8           Batesville, Ark         do         8           Newport, Ark         do         12           Pine Bluff, Ark         Arkansas         6           Black Rock, Ark         Black         7           Patterson, Ark         Cache         14           Georgetown, Ark         White         11	Woodward Okla	do	9. 5
Reno Junction, Okla         do         5           Oklahoma City, Okla         do         7           Calvin, Okla         Canadian         8           Fort Smith, Ark         Arkansas         8           Dardanelle, Ark         do         8           Little Rock, Ark         Petti Jean         8           Little Rock, Ark         Arkansas         5           Calico Rock, Ark         White         8           Batesville, Ark         do         8           Newport, Ark         do         12           Pine Bluff, Ark         Arkansas         6           Black Rock, Ark         Black         7           Patterson, Ark         Cache         14           Georgetown, Ark         White         11	Conton Okla	do	8.2
Oklahoma City, Okla         do         7.           Calvin, Okla         Canadian         8.           Fort Smith, Ark         Arkansas         8.           Dardanelle, Ark         do         8.           Danville, Ark         Petit Jean         8.           Little Rock, Ark         Arkansas         5.           Calico Rock, Ark         White         8.           Batesville, Ark         do         8.           Newport, Ark         do         12.           Pine Bluff, Ark         Arkansas         6.           Black Rock, Ark         Black         7.           Patterson, Ark         Cache         14.           Georgetown, Ark         White         11.	Pane Junation Okla	do	5. 4
Calvin, Okla.         Canadian         8           Fort Smith, Ark         Arkansas         8           Dardanelle, Ark         do         8           Danville, Ark         Petti Jean         8           Little Rock, Ark         Arkansas         5           Calico Rock, Ark         White         8           Batesville, Ark         do         8           Newport, Ark         do         12           Pine Bluff, Ark         Arkansas         6           Black Rock, Ark         Black         7           Patterson, Ark         Cache         14           Georgetown, Ark         White         11	Oklahama City Okla	do	7. 2
Fort Smith, Ark         Arkansas         8.           Dardanelle, Ark         do         8.           Danville, Ark         Petit Jean         8.           Little Rock, Ark         Arkansas         5.           Calico Rock, Ark         White         8.           Batesville, Ark         do         8.           Newport, Ark         do         12.           Pine Bluff, Ark         Arkansas         6.           Black Rock, Ark         Black         7.           Patterson, Ark         Cache         14.           Georgetown, Ark         White         11.	Colvin Oblo	Canadian	8.8
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Little Rock, Ark       Arkansas       5.         Calice Rock, Ark       White       8.         Batesville, Ark       do       8.         Newport, Ark       do       12.         Pine Bluff, Ark       Arkansas       6.         Black Rock, Ark       Black       7.         Patterson, Ark       Cache       14.         Georgetown, Ark       White       11.	Danvilla Ark	Patit Tagn	8.2
Batesville, Ark         do.         8.           Newport, Ark         do.         12.           Pine Bluff, Ark         Arkansas.         6.           Black Rock, Ark         Black         7.           Patterson, Ark         Cache         14.           Georgetown, Ark         White         11.	Tittle Dook Ask	Arkonege	
Batesville, Ark         do.         8.           Newport, Ark         do.         12.           Pine Bluff, Ark         Arkansas.         6.           Black Rock, Ark         Black         7.           Patterson, Ark         Cache         14.           Georgetown, Ark         White         11.	Colleg Dook Ask	White	8.9
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Clarendon, Arkdo	Georgetown, Ark	W ELLO	

It will be seen from the above table that there was a period of almost four weeks of continuous rains over eastern Kansas, Oklahoma, and Arkansas. From May 21 to 24, inclusive, the rains were heavy. On June 9, they were excessive over Kansas and Oklahoma, and on June 10 over Arkansas. The mean rainfall for the 28 days over the three sections mentioned was 9.60 inches, from two to more than three times the normal amount for the season, with the greatest excess over southeastern Kansas.

Hutchinson, Kans., to Wichita, Kans.—The area covered by the heavy rains was about 45 miles in length, 60 miles in width over the upper portion, and 40 miles over the middle portion, converging to about 10 miles at the extreme lower end. The flooded area was about 40 miles in width at Hutchinson, Medora, and McPherson, Kans., and became extensive southward from a line crossing the drainage area through the headwaters of Big Slough and at Hesston, Kans. The total area of farm lands flooded was about 97,000 acres and the reported damage to crops amounted to \$942,000. Damage to highways and bridges amounted to about \$95,000 and to railroads about \$335,250. In the city of Wichita, situated at the convergence of the Big and Little Arkansas Rivers and Chisholm Creek, the damage amounted to about \$840,750, making a total for the district of about \$2,213,000. About 6 square miles of the city was flooded. The crest stage in the Arkansas River at Wichita was 13.5 feet, 4.5 feet above the flood stage and the highest stage of record, and the river was above the flood stage from June 9 to 15, inclusive.

Previous high-water stages were 11 feet on May 18, 1877, 11.2 feet on Jan. 13, 1910, and 12.1 feet on June 6, 1921. The city overflow water came from the smaller